



9,10,11

SYSTEMWIDE FARE REDUCTIONS

Definition:

Level of fare is an important consideration in the decision to use transit over private vehicle. Reductions in current fare level are likely to increase ridership. This TCM looks at 10%, 20% and 50% reductions in fare compared to current levels on SEPTA.

Travel and Emissions Analysis:

This measure was defined as applying to the entire SEPTA system and all fare instruments. All transit fares were reduced by 10%, 20% and 50%, respectively, for transit path impedance calculation and mode choice calculation.

The regional mode choice model was rerun by DVRPC with these changes. Each pricing scenario was then run through a new assignment, followed by emissions estimation by COMSIS with PPAQ.

Cost Methodology:

This measure included three levels of systemwide fare reductions on all SEPTA fares. It was assumed that the travel methodology will produce a change in total transit passenger trips aggregated for all modes. Therefore, the cost methodology uses systemwide weighted average by passenger trips to calculate both capital and operating costs. The weighted average capital cost per unlinked passenger trip = \$0.64, and operating cost = \$2.00. The system weighted average calculations are based upon the 1991 Section 15 data for SEPTA.



12

IMPROVE SUBURBAN BUS SERVICE**Definition:**

This TCM would improve service on existing bus routes in the suburban counties. These improvements would include hourly off-peak service, half-hour peak service, and transfers of no more than 10 minutes.

Specific bus routes targeted for service improvements are as follows:

- 91 - Norristown to Eagleville and Graterford
- 92 - West Chester to King of Prussia
- 93 - Norristown to Pottstown
- 94 - Chestnut Hill to Montgomery Mall
- 95 - Plymouth Meeting Mall to King of Prussia
- 96 - Norristown to Telford
- 97 - Penn Square to Spring Mill
- 99 - Norristown to Royersford
- 104 - 69th St. Terminal to West Chester
- 105 - 69th St. Terminal to Ardmore or Paoli
- 118 - Chester to King of Prussia
- 120 - 69th St. Terminal to Cheyney University
- 124 - Philadelphia to King of Prussia and Chesterbrook
- 125 - Philadelphia to King of Prussia and Valley Forge National Park
- 127 - Penn del or Oxford Valley Mall to Morrisville
- 128 - Oxford Valley Mall to Bucks County Office Center
- 129 - Oxford Valley Mall to Morrell Park
- 130 - Neshaminy Mall to Oxford Valley Mall

The following assumptions were made as to the level of service improvements on these routes:

- 30-minute peak period headways
- Transfers of no more than 10 minutes
- No increase in travel speed (run times).

Travel and Emissions Analysis:

These service adjustments were evaluated using the same general process as with the other transit TCMs:



- DVRPC modified the appropriate transit links in the transit network.
- DVRPC calculated mode choice impacts through the regional mode choice model.
- Revised trip tables were assigned to the regional 1996 no-build network.
- Revised assignments were sent to COMSIS for emissions estimation with PPAQ.

Cost Methodology:

This measure would improve the existing suburban bus routes by adding off-peak and peak service. The capital cost per new passenger trip = \$0.19, and the operating cost per passenger trip = \$1.15. The revenue per new passenger trip was estimated to be \$0.51.



13

APPLICATION OF "TRANSIT-FIRST" PRINCIPLES TO SELECTED BUS AND LIGHT RAIL LINES IN PHILADELPHIA**Definition:**

SEPTA has an extensive bus and light-rail system which services the City. Under this TCM, a "transit first" policy would be invoked which would give the vehicle priority when it operates in mixed traffic and are affected by signals and crossings, and thus reduce travel time for users and increase ridership demand for transit.

Transit First principles were applied to the following selected bus and light rail lines in Philadelphia:

Routes 9, 10, 48, 52 and 56

Transit First treatment was defined as consisting of physical as well as operational improvements, resulting in a 10% reduction in travel time on the designated routes.

Travel and Emissions Analysis:

Once the routes and specific service improvements were defined, the estimation of travel and emissions impacts was determined in the same general procedure as used for the other transit TCMs:

- DVRPC modified the appropriate transit links in the transit network.
- DVRPC calculated mode choice impacts through the regional mode choice model.
- Revised trip tables were assigned to the regional 1996 no-build network.
- Revised assignments were sent to COMSIS for emissions estimation with PPAQ.

Cost Methodology:

This measure includes the application of "Transit First" principles to light rail lines in Philadelphia. It is assumed that the capital costs of the "Transit First" principles are included in other TCM measures (TCM 2), except for catenary cost of \$880,000 amortized at 8% discount rate over 10 years. The additional capital cost associated with this measure was for additional LRV vehicles; the capital cost per new passenger trip = \$0.43. The operating cost per new passenger trip = \$1.06, and the associated revenue = \$0.47.



14

REUSE OF SURPLUS LIGHT RAIL VEHICLES (LRVs) AND TRACKLESS TROLLEYS ON BUS ROUTES IN PHILADELPHIA**Definition:**

SEPTA is re-equipping 5 of its light rail routes with new vehicles. Some of the old vehicles from these routes will then be used to convert 3 bus routes back to light rail. After this conversion, there will still be about 41 surplus LRVs. In addition, SEPTA has about 50 trackless trolleys surplus to the needs of its existing trackless trolley routes. Assuming that all of these surplus vehicles could be put to use on existing bus routes in a relatively short time frame, two types of benefits could be realized: (1) air quality improvements resulting from the switch to electric power, and (2) ridership increases resulting from the change of mode.

Travel and Emissions Analysis:

This TCM was evaluated with Sketch Planning methods because no known national data of such a switch was available.

According to 1991 Section 15 data, both LRVs and trolleys have a greater average passenger count per revenue hour than buses, which could be attributed to the following:

- larger capacity of these vehicles;
- longer headways between these vehicles; and
- these vehicle modes attract more riders.

Since trolleys and buses are assumed to use the same roadways in mixed traffic, there could be a slight loss in ridership if trolleys were substituted for buses. However, this reduction would be offset by the factors given above. Also, transit generated emissions would be reduced.

Assuming LRVs are more desirable than buses, an increase in ridership is possible as long as there are no required bus-to-rail transfers, and the "Transit First" principles are implemented to increase the running speeds of the LRVs.

The impacts were calculated as follows:

Assume a 10-mile route and a speed of 10.3 mph

Assume a bus headway of 10 minutes and an LRV headway of 15 minutes

Each vehicle takes 58.2 minutes (rounded to 60 minutes) per run



6 buses or 4 LRVs will be required to serve:

Passengers per bus, peak direction in 1 hour: 52.2
Passengers per LRV, peak direction in 1 hour: 83.8

Total Pas/Hr = 315.11
Total Pas/Hr = 335.34
Difference: 20.23
or 6.42 %

41 LRVs will replace 61.5 buses and carry 10,069,602 Annual Passengers OR 646,468 additional LRV passengers.

The impact of the reduction in emissions was calculated using the delta VMT method:

1,464,500 Annual VMT reduction

5,858 Daily VMT reduction

Cost Methodology:

This measure reuses surplus LRVs and trolleys on bus routes in Philadelphia. Cost methodology is similar to TCM 13, except that there is no additional capital costs for rolling stock, since there are surplus vehicles currently available.



IMPROVE CITY TRANSIT DIVISION SERVICE

Definition:

The purpose of this TCM is to attract more people to transit service in the City by providing more frequent service. Specifically, this TCM would reduce all day headways on City Transit Division routes by 10% in order to replicate service levels of five years ago. A 10% reduction in headways was arrived at by comparing numbers from the 1991-92 Pennsylvania Mass Transit Statistical Report with the 1987-88 version.

Travel and Emissions Analysis:

DVRPC edited transit line cards of CTD routes to ultimately reflect a 10% reduction in all day headways. Travel and emissions results were then estimated through the same general process:

- DVRPC modified the appropriate transit links in the transit network.
- DVRPC calculated mode choice impacts through the regional mode choice model.
- Revised trip tables were assigned to the regional 1996 no-build network.
- Revised assignments were sent to COMSIS for emissions estimation with PPAQ.

Cost Methodology:

This measure reduced headways for the entire day on City Transit Division routes in an attempt to attract additional riders. The cost methodology is similar to that used in TCM 12, except that the capital cost for new transit vehicles was calculated using only the increase in transit for work trips, since there are sufficient off-peak surplus vehicle available.



PHILADELPHIA TO HARRISBURG RAIL SERVICE IMPROVEMENTS

Definition:

The purpose of this TCM is to increase transit utilization in the Philadelphia to Harrisburg rail corridor by offering more frequent service and increasing travel speeds.

The improvements to existing service to be analyzed were developed in the 1992 Philadelphia - Harrisburg Rail Study prepared for PennDOT by DVRPC. This report recommends a series of track improvements that would reduce travel times by 5 to 6 minutes. In addition, three future service scenarios are developed:

- (1) continue existing service,
- (2) moderate enhancement, and
- (3) high enhancement.

As a TCM, the "moderate enhancement" scenario was used. Under this scenario, service would include 10 round trips on weekdays and 7 round trips on weekends and holidays. The ridership projections and cost estimates in this 1992 report were also to be used as the source for the TCM impact estimates.

The report assumed that commuters living in Chester County and east will use the SEPTA rail service, since it is cheaper than existing AMTRAK service. Therefore, the new weekday trips are all "external" to the DVRPC region, originating in Lancaster County and traveling to downtown Philadelphia. The change in mode of travel is assumed to be from auto (at 1.25 occupancy) to intercity rail.

The estimated increase in ridership resulting from Scenario 2 vs. Scenario 1 (existing conditions) is as follows:

Philadelphia commuter	22,353 ann. pass.
Philadelphia discretionary	67,893 ann. pass.
Total	90,246 ann. pass.
Daily increase (250 days/yr)	360 pass
Round trips	180/day

It was assumed that a negligible number of Philadelphia residents would use the service to reverse



commute to Lancaster; it was further assumed that these Lancaster-to-Philadelphia commuters would reach their final destination by walking or public transit.

Travel and Emissions Analysis:

Impacts were estimated through a sketch planning technique, similar to that used for PennDOT CMAQ project evaluations:

- Assume Lancaster to Phila. trip length of 72 miles.

Portion of trip actually within DVRPC region = 49 miles

Chester County:	29 miles
Montgomery County:	15 miles
Philadelphia County:	5 miles

- Calculate change in VMT, assuming each transit trip drawn from private vehicle at 1.25 occupancy.
- Use emissions factors with delta VMT to calculate change in emissions by county.

Cost Methodology:

This measure adds rail passenger service from Harrisburg to Philadelphia as depicted in Scenario II from the 1992 DVRPC study. The capital costs are \$76.9 million, which is \$7.8 million annually. Per new passenger trip, the annual cost computations were: capital cost = \$49.83, operating cost = \$25.03, revenue = \$8.82.



17

IMPLEMENTATION OF PENNSYLVANIA EMPLOYER TRIP REDUCTION PROGRAM**Definition:**

Because the Philadelphia region is a Severe Ozone Non-Attainment Area, it will be obliged to implement mandatory ETR programs in its SIP. These programs require that regional employers of 100 or more institute measures that increase Average Vehicle Occupancy by 25% over background levels.

In its preliminary steps to implement the ETR requirement of the Clean Air Act, DVRPC defined a system of 4 AVO zones which correspond to different geographies and travel conditions in the Pennsylvania portion of the region. A different AVO target was developed for each of these four zones. These are described below along with the associated trip reduction requirement that affected employers will have to attain with their programs.

AVO Zone 1: Philadelphia Central Business District

This area is characterized by high density employment and extensive existing transit service and utilization.

Current AVO: 2.85

Target AVO: 3.00

Implied AVO Improvement: 5%

Implied Vehicle Trip Reduction: 5%

AVO Zone 2: Urban Ring

This is the area surrounding the CBD. It is also of relatively high density, includes manufacturing and warehouse activity, and still enjoys good transit service and utilization.

Current AVO: 1.54

Target AVO: 1.75

Implied AVO Improvement: 14%

Implied Vehicle Trip Reduction: 12%

AVO Zone 3: Suburban Ring

This area includes NE and NW Philadelphia, the older built-out suburban municipalities, and inner portions of Chester, Montgomery and Bucks Counties. This consists of moderate density development in stable, built-out neighborhoods, major office parks and areas of generally good transit service.



Current AVO: 1.21
Target AVO: 1.58
Implied AVO Improvement: 31%
Implied Vehicle Trip Reduction: 23.4%

AVO Zone 4: Rural Ring

This is the remaining outer portion of the region, comprised of most of Bucks and Chester Counties and the western half of Montgomery County. This area is characterized as low density development, rapid and scattered growth, and generally limited transit service.

Current AVO: 1.15
Target AVO: 1.50
Implied AVO Improvement: 30%
Implied Vehicle Trip Reduction: 23.3%

Travel and Emissions Analysis:

The impact of the mandatory ETR program on travel and emissions was estimated through the following methodological steps and assumptions:

- It was assumed that all employers of 100 or more would implement program measures necessary to hit their full trip reduction targets by 1996. *In reality, state regulations governing implementation of ETR provide for phased attainment of goals;* specifically, by 1996, employers of 1000 are only expected to reach 80% of their goal and employers under 1000 are expected to reach only 50% of their goal (full compliance by November 1997).
- Partial trip tables were developed for each of the four AVO zones, depicting home-based work travel from all regional origins (including New Jersey) to the designated AVO zone.
- Using DVRPC data, it was determined that only 79.4% of regional employees arrive at the work site between 6 to 10 a.m. These are the only trips impacted by ETR.
- Also using DVRPC data, it was determined that the percentage of employers with 100 or more employees was different in each AVO zone:

AVO Zone 1: 67.2% over 100
AVO Zone 2: 53.8% over 100
AVO Zone 3: 45.9% over 100
AVO Zone 4: 39.7% over 100

- New vehicle trip reduction ceilings were established for each AVO zone using the nominal trip reduction targets calculated above and the two assumptions related to peak period employees



(79.4%) and percentage of employers over 100:

Revised Trip Base = Daily HBW Veh. Tr. x % 6-10 a.m. x % >100

Target Trip Reduction = Rev. Base x Nominal % Trip Red.

Revised Net V.T. = Base - Target Trip Red.

Zone 1: $111,594 \times 79.4\% \times 67.2\% = 61,677$ base

Target Reduction = $61,677 \times 5\% = 3,084$ v.t.

Vehicle Trip Ceiling = $111,594 - 3,084 = 108,510$

Zone 2: $324,236 \times 79.4\% \times 53.8\% = 138,505$ base

Target Reduction = $138,505 \times 12\% = 16,621$ v.t.

Vehicle Trip Ceiling = $324,326 - 16,621 = 307,615$

Zone 3: $1,330,532 \times 79.4\% \times 45.9\% = 484,907$ base

Target Reduction = $484,907 \times 23\% = 112,983$ v.t.

Vehicle Trip Ceiling = $1,330,532 - 112,983 = 1,217,549$

Zone 4: $416,973 \times 79.4\% \times 39.7\% = 131,437$ base

Target Reduction = $131,437 \times 23\% = 30,624$ v.t.

Vehicle Trip Ceiling = $416,973 - 30,624 = 386,348$

- The TDM Model was run by COMSIS on each AVO zone situation to identify a TDM program package that, if implemented by employers of 100 +, would achieve the respective trip reduction goal. Efforts were made to make these programs (developed through trial and error) as consistent as possible across situations, and as little dependent on pricing measures as possible. The selected programs are summarized in Table 3.
- Scenarios containing these designated TDM programs were used to develop revised trip tables in the TDM model, separately for each AVO zone. Individual zonal tables were then collapsed into a revised total trip table for the Pennsylvania portion of the region.
- The revised HBW trip tables were merged with total trips and sent to DVRPC for assignment on the 1996 no-build network. The new assignment was then furnished to COMSIS for emissions estimation with PPAQ.



Table 3
Employer Trip Reduction Program Targets and Elements

AVO Zone	Employer Size	Trip Reduction	*Support Programs			Tele-commuting	Transit Subsidy	Vanpool Subsidy	SOV Parking Charge
			Transit	Carpool	Vanpool				
1	100+	5%	L4(1)				\$0		
2	100+	12%	L4(1)	L2(0)		Yes	\$60		
3	100+	23%	L4(0)	L4(0)	L2(0)	Yes	\$60	\$60	\$60
4	100+	23%	L4(0)	L4(0)	L2(0)	Yes	\$60	\$60	\$60

* The Support Programs columns should be interpreted as follows: The transit support for employers in AVO Zone 1 is currently at Level 1 and will increase to Level 4. The different levels of effort are described in detail below.

CARPOOL SUPPORT LEVELS

The values of 1 to 4 represent the level of effort the employer will put into a carpooling program.

- Level 1: Carpool information activities (tied in with areawide matching), and a 1/4 time transportation coordinator.
- Level 2: In-house carpool matching services and/or personalized carpool candidate get-togethers (including information activities), and a 1/4 time transportation coordinator.
- Level 3: In-house carpool matching and information services, plus preferential (reserved, inside, and/or especially convenient) parking for carpools, a policy of flexible work schedules to accommodate carpools, and a 1/2 time transportation coordinator.
- Level 4: In-house carpool matching and information services, plus preferential parking for carpools, flexible schedules, guaranteed ride home, and a full-time transportation coordinator.



VANPOOL SUPPORT LEVELS

The values of 1 to 4 represent the level of effort the employer will put into a vanpool program.

- Level 1: Vanpool information activities (tied in with areawide vanpool matching and/or third-party vanpool programs), plus a 1/4 time transportation coordinator.
- Level 2: In-house vanpool matching services, and/or personalized vanpool candidate get-togethers, and non-monetary vanpool development, plus 1/4 time transportation coordinator and a policy of flexible work schedules.
- Level 3: In-house vanpool matching services, vanpool development and operating assistance including financial assistance such as vanpool purchase loan guarantees, consolidated purchase of insurance, and start-up subsidy (generally at least two forms of such financial assistance), and additional incentives such as van washing and preferential (reserved, inside, and/or especially convenient) parking for vanpools, plus a 1/2 time transportation coordinator.
- Level 4: In-house vanpool matching services, vanpool development and operating assistance including major financial assistance such as employer purchase of vans with favorable leaseback (or alternative continuing subsidy to keep vanpool fares low) in addition to start-up subsidy, several additional incentives such as van washing, preferential parking for vanpools and guaranteed ride home, and a full-time transportation coordinator, and/or personalized vanpool candidate get-togethers.

TRANSIT SUPPORT LEVELS

The values of 1 to 4 represent the level of effort the employer will put into a transit program.

- Level 1: Transit information center plus 1/4 time transportation coordinator.
 - Level 2: Transit information center and a policy of work hours flexibility to accommodate transit schedules/delays, plus 1/4 time transportation coordinator.
 - Level 3: Transit information center and a policy of work hours flexibility, on-site bus pass sales, plus a 1/2 time transportation coordinator.
 - Level 4: Transit information center and a policy of work hours flexibility, on-site bus pass sales, guaranteed ride home, and a full-time transportation coordinator.
-

**Cost Methodology:**

This measure is the full mandatory implementation of the employer trip reduction program. The public cost of administering the program was estimated by a 1992 Ernst & Young Study of Regulation XV to be \$2300 per plan. The other portion of the public costs was in the provision of additional transit service. The transit cost methodology for the additional transit service was outlined in the description for TCMs 9, 10, and 11. One of the ETRP components is the administering of transit passes sold at various discounts. The public has a cost to administer this program. This annual cost was assumed to be 10% of the value of the transit pass subsidy (\$2,611,239).

The private cost was \$105 per employee for all employers with over 100 employees (\$79,472,505), plus the transit subsidy based upon the AVO zone subsidy levels (\$26,112,394), and the telecommute cost of \$350 per employee which telecommutes (\$5,354,780). Private revenue of \$184,046,340 was calculated by multiplying \$3 per day for each single occupant vehicle employee car parked for employees working in firms with over 100 employees.



18

COMPREHENSIVE REGIONAL RIDESHARING PROGRAM**Definition:**

This TCM encompasses a full range of institutional aids and support actions to encourage interest in ridesharing. These incentives include improved regional rideshare matching capabilities, guaranteed ride home, and satellite stations at TMAs, large employers and office parks.

An effort was made to define the application of this measure such that its impacts would be in addition to those attributable to ridesharing as a part of TCM 17 (ETRP). Thus, the travel and emissions impacts of TCMs 17 and 18 should be roughly additive.

It is assumed that a publicly-based Regional Rideshare program would be effective in the following manner:

- While employers over 100 under mandatory ETR will implement their own rideshare support programs, it is assumed that the Regional Rideshare program might fairly be credited with *half* of the rideshare mode shift and transit mode shift associated with "employer support" strategies under ETRP as captured in the TDM Model.
- All other employees -- those in (1) firms under 100, (2) in AVO zones where employer rideshare or transit "support" was not applied under ETR, or (3) employees in firms over 100 that were not part of the 6-10 a.m. target population -- would be assumed to receive nominal rideshare/transit support.

Travel and Emissions Analysis:

The travel and emissions impacts of this TCM were evaluated using the TDM and PPAQ Models through the following steps:

- Carpool, Vanpool and Transit support were set at Level 2 in the TDM model for all 4 AVO zones. This approximates a reasonable level of information, promotion, and encouragement such as might be derived from a regional program as is proposed by DVRPC.
 - To account for impacts due to employer support of ridesharing and transit already applied under ETRP (to avoid double counting of benefits with TCM 17), the TDM model was then run at Level 2 Carpool, Vanpool and Transit support just for the ETR-affected sample, and these vehicle trip reductions (transit trip increases) were then netted out of the simulation above.
 - The revised trip tables resulting from the above analysis were merged with the rest of regional
-



trip table and transmitted to DVRPC for assignment to 1996 no-build network, which was then returned to COMSIS for estimation of emissions using the PPAQ model.

Cost Methodology:

This measure encompasses a full range of actions to encourage interest in ridesharing including improved regional rideshare matching capabilities, guaranteed ride home, satellite stations at TMAs, large employers and office parks. The public costs were provided by DVRPC to administer this program, estimated to be \$750,000 annually. The private cost was calculated as \$1.00 per employee, or \$853,505, which represents only a nominal cost to the private sector and should cover the program outlined above.

**Cost Methodology:**

This measure promotes the transit subsidy equal to the ETRP program. This TCM is only for all other employees not covered by the ETRP. The public cost of providing additional transit service is similar to TCMs 9, 10, and 11. The administration cost of the TransitChek program was estimated to be 10% of the value of issued TransitCheks. The private cost has two parts: the first was the proportional cost of the \$105 per employee in the ETRP, TCM 17, which is 17.2% or \$18 per employee for administration, and second the direct employer subsidy, which was calculated at \$616 per participating employee.



AVAILABILITY AND PROMOTION OF TRANSITCHEK

Definition:

TransitChek is a mechanism through which employers can subsidize employee's use of transit. The employer purchases check-like instruments from the transit provider which may then be used by the employee for up to a certain dollar value of transit service per month. Thanks to the Federal Energy Bill of 1992, previous caps on employer subsidy of \$21 per month were raised to \$60, which can be used by employers as an important tax-exempt fringe benefit for employees.

An effort was made to define the application of this measure such that its impacts would be in addition to those attributable to the transit subsidy as a part of TCM 17 (ETRP). Thus, the travel and emissions impacts of TCMs 17 and 19 should be roughly additive.

Travel and Emissions Analysis:

The following assumptions were made in estimating the likely impact of this measure on travel and emissions:

- It was assumed that the average employer transit subsidy under this TCM would be \$25 per month (this works out to \$1.15 per day, x .58 (1980 to 1993 time deflation factor) = \$.67 per day).
- Since AVO zones 2, 3 and 4 all had ETR programs which featured Transit Subsidies of at least \$25 (actually \$60/mo.) to 79.4% of all employees in employers of 100 +, it was assumed that only the remaining 21% of employees would receive the \$25 subsidy amount.
- For employers with fewer than 100 employees in all AVO zones, it was assumed that a \$25 monthly transit subsidy would be available to 50% of all such employees.
- In AVO zone 1, where there was no ETRP transit subsidy, it was assumed that 50% of all employees with employers of 100+ would also get the \$25 subsidy.

The impacts of the above conditions on travel were calculated using the TDM Model. A revised trip table was produced which was merged with total travel and then transmitted to DVRPC for assignment to the 1996 no-build network. Assignment results were then returned to COMSIS where emissions effects were estimated using the PPAQ model.



TELECOMMUTING

Definition:

This measure assumes that Pennsylvania employers will make liberal use of telecommuting among their employees, wherein the employee could work at home using modern telecommunications hookup and avoid a physical trip to the central workplace on one or more days per week.

An effort was made to define the application of this measure such that its impacts would be in addition to those attributable to telecommuting as a part of TCM 17 (ETRP). Thus, the travel and emissions impacts of TCMs 17 and 20 should be roughly additive.

Travel and Emissions Analysis:

A two-part analysis was used to estimate the impacts of a regional telecommuting initiative:

(1) Potential for Telecommuting in Regional Employment Base

Regional employment (Pennsylvania sector) was distributed by SIC code. Based on national telecommuting studies and application of judgement, an assessment was made of the potential of each SIC group to support telecommuting. This assessment, which is detailed in Table 4, suggests the percentage of employers in the SIC group who "could" implement telecommute based on the characteristics of their activities and the reasonableness of conducting their functions through employees who are not on-site, even for a portion of a week.

The following is a summary of the degree to which particular SIC groups could support Telecommuting (shows percent of employment situations in the stated group, who *could allow their employees to telecommute*):

- 100%: Trade Associations (SIC 86), Engineering and Mgt. Consult. Svcs. (87), Misc Services (89); this is 4.9% of regional base.
 - 50%: Government (SIC 90); this is 12% of regional base.
 - 25%: Finance/Investment/Real Estate (SIC 60-67), Business Services (73); this is 13.5% of the regional base.
 - 10%: Health Services (80), Legal Services (81), Educational Services (82); this is 14% of the regional base.
-



None: All manufacturing, industrial and trade (SICs 01 through 59); Hotels (70); Personnel Services (72); Auto Repair (75); Movies and Amusements (78-79); Social Services (83); and Museums/Gardens (84). This non-eligible group comprises 55.6% of the regional base.

Thus, the effective potential base for telecommuting covers 15.6% of the regional employment base.

(2) Estimate Travel Changes Resulting from Telecommuting

The COMSIS TDM Model was used to translate this eligibility to actual travel changes. Drawing upon a synthesis of national experience as reported in a 1992 study by Daniel Rathbone: *Telecommuting in the United States* (ITE Journal, Dec. 1992), the following relationships were assumed:

If telecommute is offered by an employer, 32% will actually do so.

Of those who telecommute, the average number of days per week that the employee telecommutes is 1.8 days.

The TDM model was calibrated to include these rates. To ensure that the regional telecommute program would be independent of telecommute measures included under ETRP (TCM 17), the following additional steps were then taken:

In AVO zone 1, where no telecommuting measures were applied under ETRP, telecommuting was assumed to be offered to all eligible employees (as defined by SIC code above) regardless of size (over or under 100).

In AVO zones 2 through 4, where telecommute was assumed for employers of 100+, telecommuting was assumed to apply to all eligible employees in firms under 100, and to only 21% (100% less 79.4%) of those in firms of 100+.

The TDM model was run on the HBW trip table with the assumptions regarding telecommuting as delineated above. The resulting revised trip table was merged with total regional travel and sent to DVRPC for assignment to the 1996 no-build network. The assignment was then returned to COMSIS for estimation of emissions using the PPAQ model.

Cost Methodology:

There was no public cost of this program, except for the public sector as an employer participating in the telecommute program. It was assumed that there is a \$350 private cost per telecommute employee, based upon a Federal Highway Administration study for purchase of computer equipment and accessories.



Table 4
Telecommuting Potential

SIC Code	Description	DVRPC-PA 1990 Employment	Overall Percent	Tele- commute Potential	Tele- commute % Eligible	Potential # of Tele- commuters
01-09	Agriculture	24,671	1.3	None	0.0	0
10-14	Mining	2,014	0.1	None	0.0	0
15-17	Construction	96,123	4.9	None	0.0	0
20-39	Manufacturing	278,800	14.2	None	0.0	0
40-49	Transportation	80,426	4.1	None	0.0	0
50-51	Wholesale Trade	111,695	5.7	None	0.0	0
52-59	Retail Trade	326,771	16.6	None	0.0	0
60-67	FIRE	164,600	8.4	25%	2.1	41,150
70	Hotels/Lodging	12,220	0.6	None	0.0	0
72	Prsnl. Services	18,077	0.9	None	0.0	0
73	Business Services	100,085	5.1	25%	1.3	25,021
75	Auto Repair	14,978	0.8	None	0.0	0
78	Movies	5,388	0.3	None	0.0	0
79	Amusements/Recreation	13,492	0.7	None	0.0	0
80	Health Services	188,071	9.6	10%	1.0	18,807
81	Legal Services	24,451	1.2	10%	0.1	2,445
82	Educ. Services	63,067	3.2	10%	0.3	6,307
83	Social Services	41,299	2.1	None	0.0	0
84	Musms./Gdn.	1,500	0.1	None	0.0	0
86	Mbrs. Trd. A.	33,123	1.7	100%	1.7	33,123
87	Engr. Mgt. Sv.	59,633	3.0	100%	3.0	59,633
89	Misc. Services	3,629	0.2	100%	0.2	3,629
90	*Govt. - All	235,473	12.0	50%	6.0	117,737
	*TOTALS	1,899,584	96.5		15.6	307,851
	*Ttl. Emp. (PA)	1,967,884				16.2% of TOTALS
	Office Ttl. Only	979,084				31.4% of Office Ttl.

*Govt. - All = Excludes Military

*TOTALS = Excludes Railroad Employees and Self-employed Persons

*Ttl. Emp. = Includes Railroad Employees and Self-employed Persons



21

COMPRESSED WORK WEEKS**Definition:**

Compressed work weeks may be an effective way of reducing daily vehicle travel and VMT. This measure is defined as relevant employers in the Pennsylvania portion of the DVRPC region offering a shortened work week to all or some of their employees. There are numerous types of compressed work week; this test is limited to a 9/80 arrangement, where the employee works an average 9-hour day for 9 days over an 80-hour (2-week) cycle and receives the 10th day off.

Note: This measure is independent of TCM 17 (ETRP), since Compressed Work Weeks were not considered as a measure in the employer plans. Hence, this measure may be considered additive with TCM 17.

Travel and Emissions Analysis:

A two-part analysis was used to estimate the impacts of a regional 9/80 compressed work week initiative:

(1) Potential for Compressed Work Week in Regional Employment Base

Regional employment (Pennsylvania sector) was distributed by SIC code. Based on national studies and application of judgement, an assessment was made of the potential of each SIC group to support compressed work weeks. This assessment, which is detailed in Table 5, suggests the percentage of employers in the SIC group who "could" implement compressed work weeks based on the characteristics of their work and the likelihood that those functions could be performed effectively if the site were not open 5 days per week.

The following list summarizes the degree to which particular SIC groups could support Compressed Work Weeks (shows percent of employment situations in the stated group who *could* allow their employees to have a compressed work week schedule):

100%: None

50%: Trade Associations (SIC 86); this is 1.7% of regional base.

25%: Finance/Investment/Real Estate (SIC 60-67), Business Services (73); Social Services (83); Engineering and Management Services (87); Miscellaneous Services (89); and Government (SIC 90); this is 24.8% of the regional base.



10%: Personnel Services (72), Health Services (80), Legal Services (81), this is 11.7% of the regional base.

None: All manufacturing, industrial and trade (SICs 01 through 59); Hotels (70); Auto Repair (75); Movies and Amusements (78-79); Educational Services (82); and Museums/Gardens (84). This non-eligible group comprises 61.8% of the regional base.

Thus, the effective potential base for compressed work week covers 9.7% of the regional employment base.

(2) Estimate Travel Changes Resulting from Compressed Work Weeks

The COMSIS TDM Model was used to translate this eligibility to actual travel changes. Using straight mathematics, a person who participated in a 9/80 work week would travel 10% less over a 2-week period (eliminate 1 day in 10). It was assumed that this day would be randomized by employers, i.e., that any weekday would be equally likely to be the day off (more likely to be a Monday or Friday), such that the effect on regional travel would be a 10% reduction in HBW travel on a given weekday.

Using the TDM Model, the percent eligibility was set at 9.7% and the reduction rates applied to all 1996 HBW trips with destinations in the Pennsylvania portion of the region. Evaluation of this scenario with the TDM model resulted in a revised HBW trip table which was then merged with total travel (complete regional trip table) and transmitted to DVRPC for assignment to the 1996 no-build network. The assignment was then returned to COMSIS for emissions estimation using the PPAQ model.

Cost Methodology:

This measure assumes that the effects of a compressed work week would remove single occupant commuters from the peak periods. There was no significant public capital cost of this program. The public transit operating costs and subsidies will be reduced to reflect the reduction in transit ridership.



Table 5
Compressed Work Week Potential

SIC Code	Description	DVRPC-PA 1990 Employment	Overall Percent	Compressed Work Week Potential	Compressed Work Week % Eligible	Potential # of CWW commuters
01-09	Agriculture	24,671	1.3	None	0.0	0
10-14	Mining	2,014	0.1	None	0.0	0
15-17	Construction	96,123	4.9	None	0.0	0
20-39	Manufacturing	278,800	14.2	None	0.0	0
40-49	Transportation	80,426	4.1	None	0.0	0
50-51	Wholesale Trade	111,695	5.7	None	0.0	0
52-59	Retail Trade	326,771	16.6	None	0.0	0
60-67	FIRE	164,600	8.4	25%	2.1	41,150
70	Hotels/Lodging	12,220	0.6	None	0.0	0
72	Prsnl. Services	18,077	0.9	10%	0.1	1,808
73	Busi. Services	100,085	5.1	25%	1.3	25,021
75	Auto Repair	14,978	0.8	None	0.0	0
78	Movies	5,388	0.3	None	0.0	0
79	Amsmts./Rec.	13,492	0.7	None	0.0	0
80	Health Services	188,071	9.6	10%	1.0	18,807
81	Legal Services	24,451	1.2	10%	0.1	2,445
82	Educ. Services	63,067	3.2	None	0.0	0
83	Social Services	41,299	2.1	25%	0.5	10,325
84	Musms./Gdn.	1,500	0.1	None	0.0	0
86	Mbrs. Trd. A.	33,123	1.7	50%	0.8	16,561
87	Engr. Mgt. Sv.	59,633	3.0	25%	0.8	14,908
89	Misc. Services	3,629	0.2	25%	0.0	907
90	*Govt. - All	235,473	12.0	25%	3.0	58,868
	*TOTALS	1,899,584	96.5		9.7	190,801
	*Ttl. Emp. (PA)	1,967,884				10.0% of TOTALS
	Office Ttl. Only	979,084				19.5% of Office Ttl.

*Govt.- All = Excludes Military

*TOTALS = Excludes Railroad Employees and Self-employed Persons

*Ttl. Emp. = Includes Railroad Employees and Self-employed Persons



22

PROHIBIT NEW CONSTRUCTION OF PARKING FACILITIES IN CENTER CITY**Definition:**

This TCM would further constrain parking supply in the Center City by restricting the construction of any new parking downtown between now and 1996. The effect would be to reduce the overall parking ratio, thus limiting the number of vehicles which could park downtown, while also, presumably, raising the cost of parking at the remaining spaces.

Travel and Emissions Analysis:

This measure was evaluated using Sketch Planning techniques. It was assumed that the predominant effect would be in restricting parking supply such that vehicles physically could not park, thus forcing a shift to alternative modes. While such a constraint on space would likely also increase prices, there was no way to estimate what such an increase would be.

To estimate the impact on restricting parking supply relative to demand, the following analysis was performed:

- Change in employment in the Center City was estimated using Planning Area employment data from DVRPC for Planning Area 1:

● Increase in employment, Zone 1:

1996 Employment Forecast:	288,656
1990 Employment Actual:	287,887

New Jobs:	769
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Interpolate jobs, 1994-96: $2/6 (769) = 254$

- Calculate Vehicle Trip Demand: $24.9\% \times 254 = 63$ new trips

Assume that this net increase in vehicle trip demand can be met by existing parking supply. Hence, no impact is assumed from this measure.
